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ORIGINAL ARTICLE

A Psychometric Study of the Model of Human Occupation Screening Tool (MOHOST)

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Objective: This study examined the psychometric properties of the Model of Human Occupation Screening Tool (MOHOST) using item response theory and classical test theory approaches for clients with psychiatric disorders.
Methods: Data, including demographic variables and scores on the MOHOST and a version of the Health of the Nation Outcomes Scale, were retrieved from case records of 1039 adult psychiatric service users.
Results: Participants ranged in age from 18 to 102 and 57% were female and 43% were male. Most (94%) were unemployed, retired, or receiving other education or training. The items that make up each of the MOHOST subscales demonstrated good discriminant validity and excellent goodness of fit showing that the items measured the MOHO constructs unidimensionally. All subscales were able to distinguish clients into at least three statistically distinct strata and showed convergence with an independent measure of functioning.
Conclusion: Findings from this study must take into account implicit limitations associated with the use of Rasch analysis and classical test theory. At the same time, results did support use of the MOHOST for research and clinical purposes. The MOHOST demonstrated good construct validity, item separation reliability, and concurrent validity. As a measure of occupational participation, the MOHOST offers practitioners and researchers a valid and reliable measure of volition, habituation, communication/interaction skills, process skills, motor skills, and environmental influences on participation.

KEY WORDS: Assessment psychometrics • Model of Human Occupation • Model of Human Occupation Screening Tool (MOHOST) • Participation assessment

Introduction

The Model of Human Occupation Screening Tool (MOHOST) (Parkinson, Forsyth, & Kielhofner, 2006) is an assessment that gives a broad overview of personal and environmental factors that influence clients' occupational participation. The tool includes six subscales that examine volition, habituation, motor skills, process skills, communication/interaction skills, and the environment. Previous research has provided preliminary empirical support for the reliability and validity of this tool. The present study continues psychometric evaluation of the MOHOST using a large sample.

The MOHOST (Parkinson et al., 2006) was developed by occupational therapy practitioners based on their need for a

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concise, comprehensive, and goal-based screening and outcomes measure. Rooted in one of the most widely-used conceptual practice models, the Model of Human Occupation (MOHO) (Kielhofner, 2008), the MOHOST measures the major concepts that drive clinical reasoning according to MOHO. These include (a) volition (a client's motivation to engage in occupation), (b) habituation (the way in which a client patterns activities and engages in daily habits and routines), (c) performance capacity (a client's available motor, process, and communication skills) and (d) environment (to what extent a client's physical and social environments support or inhibit occupational functioning and engagement). Each of the six subscales is operationally defined as follows: (a) volition (appraisal of activity, expectations for success, interest, choices), (b) habituation (routine, adaptability, roles, and responsibility), (c) communication/interaction skills (nonverbal skills, conversation, vocal expression, and relationships), (d) process skills (knowledge, timing, organization, and problem-solving), (e) motor skills (posture and mobility, coordination, strength and effort, and energy), and (f) environment (physical space, physical resources, social groups and occupational demands). These can be considered independently or combined to produce an overall estimate of occupational engagement and participation. Each item is rated on a 4-point scale according to the following acronym: FAIR (F = facilitates occupational participation, A = allows occupational participation, I = inhibits occupational participation, R = restricts occupational participation).

Previous Research on the MOHOST

A study of 166 participants employed confirmatory factor analysis to ask whether the MOHOST items represent six factors influencing participation (Kielhofner et al., 2009). The study found that the delta chi-square which measured the improvement in fit between one- and six-dimensional models was 665.54 on 15 degrees of freedom, which was highly significant. Moreover, standardized coefficients (which ranged from .49 to .87) also indicated that the items which make up each of these factors were well designed to capture that factor.

A second study of 54 clients in an inpatient rehabilitation unit found that the MOHOST could be used to detect change in clients from initial assessment to discharge (Kramer, Kielhofner, Lee, Ashpole, & Castle, 2009). MOHOST item calibrations remained stable over time; this demonstrated that therapists were consistent in their interpretation of items over time, indicating that the MOHOST can validly measure change. The MOHOST total score and the motor skills and environment subscales significantly increased between admission and discharge. This study also found that the MOHOST was used in a consistent and interchangeable manner by occupational therapists. The separation index was 1.12, which indicates that therapists exhibited less than two significantly different levels of severity/leniency when rating clients.

A third study examined the internal consistency, construct validity, concurrent validity, and interrater reliability of a Chinese translation of the MOHOST with 101 clients with psychiatric disorders (Fan, 2008). Rasch analysis and classical psychometric approaches were used. Findings revealed that the items which made up the six subscales of the MOHOST discriminated and ranked clients along a continuum in terms of the amount in which they participated in work during occupational therapy intervention. Moreover, the subscales measuring volition, habituation, communication/interaction, process and motor skills showed adequate goodness of fit, excellent item separation reliability, and unidimensionality in measurement. This means that the items cohered to measure a unidemensional construct (i.e. the volition, habits, and performance capacity of the person or client) and that they appropriately ranked clients along a continuum without redundancy between items. Similar results were found when the items comprising the environmental subscale were examined.

This previous study (Fan, 2008) also provided evidence of concurrent validity with a selected number of other measures, including the Volitional Questionnaire (de las Heras, Geist, Kielhofner, & Li, 1998), the Assessment of Communication and Interaction Skills (Forsyth, Salamy, Simon, & Kielhofner, 1998), and the Mini Mental State Examination (Folstein, Folstein, & McHugh, 1975). The Volitional Questionnaire (de las Heras et al., 1998) strongly correlated with the motivation for occupation subscale ($r = .58$) and the Assessment of Communication and Interaction Skills (Forsyth et al., 1998) strongly correlated with the communication and interaction subscale ($r = .82$), as expected. The Mini Mental State Examination (Folstein et al., 1975), which measures cognition, was moderately correlated with the process skills subscale ($\gamma = .33$); this was an expected correlation since cognitive problems have a direct impact on process skills. Finally, a measure of psychiatric symptomatology was not associated with any of the subscales, as expected, since the MOHOST aims to capture factors that support occupational participation (what are referred to as negative symptoms of mental illness) rather than positive symptoms of mental illness. Additional evidence of the validity of the subscales was that there were significant differences on selected subscale scores across four known groups of subjects.

In summary, previous studies of the MOHOST have made a beginning argument for the relevance, utility, reliability, and validity of this measure in research and clinical practice. Classical approaches, such as confirmatory factor analysis, have shown that the six subscales represent independently measurable

concepts (Kielhofner et al., 2009). Other studies have shown that certain subscales of the instrument have been found to detect change (Kramer, Kielhofner et al., 2009) and demonstrate concurrent validity with measures of similar constructs (Fan, 2008). At the same time, additional research that further establishes the reliability and validity of the MOHOST with larger samples and more heterogeneous populations using different measures and mixed-methodological approaches are needed to provide continuing support for this argument. If this additional evidence were obtained, it would support use of the MOHOST with a wider range of clients and it would also show cross-cultural application. Therefore, the objective of this study was to examine the psychometric properties of the MOHOST using item response theory and classical test theory approaches in a large sample of clients receiving services in the United Kingdom.

Methods

Study Aim and Design

This study aims to build on previous psychometric research by examining the MOHOST with a much larger and more heterogeneous population so that findings from prior studies may be tested more rigorously across a wider range of diagnostic groups with varying levels of occupational functioning. The study combines an item response theory approach via the Rasch Measurement model (Rasch, 1960, 1980; Wright & Stone, 1979) with classical test theory approach. Combining Rasch measurement approach with classical test theory enables a more comprehensive assessment of an instrument (Kyngdon, 2004; Mok, 2004) and has been applied to other MOHO assessments (Asgari & Kramer, 2008; Kramer, Smith, & Kielhofner, 2009; Taylor, Lee, Kramer, Shirashi, & Kielhofner, in press).

Instruments

Two measures were used in this study, the MOHOST and the Health of the Nation Outcome Scale (HoNOS).

The Model of Human Occupation Screening Tool (MOHOST) (Parkinson et al., 2004) captures information on the influence of personal and environmental factors on occupational participation. The instrument consists of 24 items, four items for each of the following variables: volition (referred to as "motivation for occupation" in the MOHOST), habituation (referred to as "pattern of occupation" in the MOHOST), communication and interaction skills, process skills, motor skills, and environment. For example, one of the items in the volition subscale assesses whether the respondent shows awareness of strengths and limitations. Each of the MOHOST item is rated using a 4-point rating scale that indicates the influence of the variable represented by the item on the client's occupational participation (i.e. 4 = *facilitates*, 3 = *allows*, 2 = *inhibits*, 1 = *restricts*). The instrument is scored based on a combination of observation, interview, case notes, and/or proxy report; the practitioner determines the methods that are most suited to each client.

The Heath of the Nation Outcome Scale (HoNOS) instrument (Wing, Curtis, & Beevor, 1996; Wing et al., 1998) is an internationally recognized outcome measure developed by the Royal College of Psychiatrists in the United Kingdom. The HoNOS is mandated to be used in mental health services in England. It was selected as the criterion measure in this study for two reasons: convenience in records retrieval and the opportunity to establish concurrent validity with an internationally known psychiatric outcomes measure. In this study, we asked if selected subscales of the MOHOST would correlate with items from the HoNOS-Payment by Results (PbR) assessment that targeted variables that would be expected to have an association with the trait targeted by the subscale.

The HoNOS-PbR is a version of the HoNOS with additional items; it is being used as part of a PbR reimbursement system in England to determine needs for services among clients with mental health problems. This instrument identifies the extent of problems related to symptoms and severity of mental illness (e.g. hallucinations, self-harm, depression) and to functional problems (e.g. cognitive problems, problems with activities of daily living). Each item is rated on a scale from 0 = *no problem* to 4 = *severe to very severe* problem. The HoNOS-PbR can be used along with diagnostic data to differentiate clients into different categories of need. The broadest determination divides clients into three categories: non-psychotic mental health problems, psychosis, and organic/cognitive problems.

Data Collection

This study made use of data extracted from clinical records from South West London and St. George's Trust (SWLSGT) and South West Yorkshire Partnership Foundation Trust (SWYPFT). Beyond being a participating service user with a psychiatric diagnosis, selection criteria were not established for this study because our aim was to test a client population that was heterogeneous and as closely reflective of current clients in the United Kingdom as possible. Restricting the sample in terms of levels of functioning or sociodemographic characteristics might have introduced artifacts and confounds into the findings. Ethical permission for the study was obtained within both trusts and from the University of Illinois at Chicago where the data were analyzed. Participants were selected from the two trusts, which use similar electronic patient record systems and had both HoNOS-PbR and MOHOST scores. SWLSGT had MOHOST and HoNOS-PbR data collected over a period of 2 years while SWYPFT had approximately 6 months of data

recorded. Data were collected from service users' electronic medical records over the period that the trusts had been using and recording MOHOST data. Approximately two-thirds of the records had data from both instruments while a third had data from only the MOHOST.

Statistical Analysis

As noted earlier, our approach to analyzing the data combined Rasch analysis with statistical approaches associated with classical test theory. Data were imported into SPSS 17.0 (SPSS Inc., Chicago, IL, USA), which was used for descriptive and inferential statistical analysis. Rasch analysis was performed using Facets for Windows Version No. 3.62.0 (SPSS Inc., Chicago, IL, USA).

Rasch Analysis

Rasch analysis examines validity by generating evidence about the scale's ability to capture underlying characteristics or "latent traits" that are targeted by the scale (Wolfe & Smith, 2007). The MOHOST subscales are designed to capture the following latent traits: motivation for occupation (volition), pattern of occupation (habituation), communication and interaction skills, motor skills, process skills, and environment. Rasch analysis provides fit statistics for each item that indicate whether the item "fits" with the rest of the subscale items in targeting the intended trait. Item fit statistics include a mean square (*MS*), which indicates the amount of information versus error that is provided about the intended trait; an ideal *MS* is 1.0. A MnSq well below 1.0 indicates that the item is less variant than desired and thus gives limited information about the intended trait. A *MS* well above 1.0 indicates the item provides too much error and is thus a threat to validity. The *z* (standardized as a *z* score) indicates the level of significance of the *MS*. In keeping with the recommended standards (Bray, Fisher, & Duran, 2001; Velozo, Kielhofner, & Lai, 1999; Wright & Linacre, 1994), fit statistics of $MS > 1.4$ associated with $z > 2.0$ were taken as an indication of an item misfit.

Rasch analysis can also be used to provide information about the construct validity of the MOHOST subscales by providing a person separation index. This person separation statistic can be converted into strata, or (4[separation index] + 1)/3, which indicate the number of significant different levels of the construct that is represented by the items (Wright & Masters, 1982). Additionally, Rasch analysis provides a coefficient that indicates the reliability with which the instrument is able to discriminate persons into these strata. Finally, Rasch provides a person fit statistic that indicates whether the person was validly measured by the scale; for clinical measures a person misfit rate of no more than 5% is desirable.

Table 1. Expected correlations for convergent validity

MOHOST subscale	HoNOS-PbR item
Volition	Problems with activities of daily living
Habituation	Problems with activities of daily living
Communication/interaction skills	Problems with relationships
Process skills	Cognitive problems
Motor skills	Physical illness or disability problems
Environment	Problems with living conditions

MOHOST = Model of Human Occupation Screening Tool; HoNOS-PbR = National Outcome Scale–Payment by Results.

Classical Test Theory Analyses: Convergent and Known Group Validity

Classical test theory provides evidence of validity by asking questions based on assumptions about the targeted construct and its relationship to other variables. Two common approaches that were used in this study are convergent and known group validity. Convergent validity refers to the expectation that measures intended to capture related traits should be correlated (Campbell & Fiske, 1959; Kielhofner, 2006). The relationships that were expected are shown in Table 1. Spearman's correlation coefficients were used for this analysis since the ratings on the HoNOS-PbR items were ordinal. Since the HoNOS-PbR items targeted traits related to but not identical to the subscales and because these were single items, we expected modest correlations.

Finally, known group validity refers to the ability of the scale to discriminate among groups with different levels of disability. In order to examine this, we compared MOHOST subscale scores across three groups of participants. They included (a) those with psychosis, (b) those with nonpsychotic mental health problems, and (c) those with organic/cognitive problems. Analysis of Variance (ANOVA) and a Tukey HSD post hoc procedure were used to identify if there were differences in the measures for the six subscales of the MOHOST among three groups of subjects. Bonferonni correction was used to address the problem of multiple significance comparisons; thus, the alpha was set to (.05/6 tests) for the ANOVAs.

Results

Participants' Demographic Characteristics

Data were retrieved from 1039 clients who served as participants in this study. Participants included 590 females (56.8%) and 449 males (43.2%). They ranged in age from 18 to 102;

the average age was 61.03 (*SD* = 22.28). Employment data were available on 600 of the participants. Of these, 38 (6.3%) were employed, 292 (48.7%) were of employment age and unemployed, 44 (7.3%) clients were receiving other education/training, 24 (4%) were unknown, and 202 (33.7%) were retired. Of the 608 on whom there was housing data, most (69.4%) lived in mainstream housing; others were homeless (5.6%), living in accommodation with mental health support (8.2%), living in residential facilities (13.0%), or living in other sheltered or accommodation settings (3.8%).

Item Fit

Table 2 showed the results of the Rasch analysis for each subscale of the MOHOST. None of *MS* for the items exceeded 1.4.

Table 2. Item fit statistics for the six MOHOST subscales

Items	Infit	
	MS	*z*
Subscale 1: Motivation for occupation		
Appraisal of abilities	1.05	1.1
Expectation of success	1.02	0.4
Interest	0.97	–0.6
Choice	0.91	–1.9
Subscale 2: Pattern of occupation		
Routine	1.02	0.4
Adaptability	1.03	0.7
Responsibility	1.03	0.6
Roles	0.90	–2.3
Subscale 3: Communication and interaction skills		
Nonverbal skills	0.87	–2.8
Conversation	0.88	–2.8
Vocal expression	0.91	–1.8
Relationships	1.3	6.3
Subscale 4: Process skills		
Knowledge	1.06	1.3
Planning	0.91	–1.9
Organization	0.90	–2.1
Problem-solving	1.05	1.1
Subscale 5: Motor skills		
Posture & mobility	0.93	–1.5
Coordination	0.98	–0.3
Strength & effort	0.79	–4.7
Energy	1.24	4.7
Subscale 6: Environment		
Physical space	0.98	–0.4
Physical resources	0.82	–4.0
Social groups	1.12	2.5
Occupational demands	1.03	0.7

MOHOST = Model of Human Occupation Screening Tool; *MS* = mean square.

In fact, most items were very near an ideal *MS* of 1.0. These findings indicated that the items within each subscale were targeting the intended construct.

Person Separation, Reliability and Validity

Table 3 shows separation statistics. All six subscales of the MOHOST were able to discriminate subjects into at least three statistically distinct levels. The reliability with which subjects were discriminated into levels ranged from .81 to .89. An average of 4.76% of participants misfit across the six subscales. Rates of misfit for the subscales ranged from 3.50% (motor skills) to 6.17% (environment).

Convergent Validity

Table 4 shows the correlations between MOHOST subscales and HoNOS-PbR items. As expected, the volition and habituation subscales were correlated with activities of daily living. The communication/interaction, process, and motor skills subscales were correlated, respectively, with the items "problems with relationships," "cognitive problems," and "physical illness or disability problems." Finally, the item "problems with living conditions" was correlated with the environment subscale.

Discriminant Validity

Table 5 shows results of the ANOVA analyses. All six subscales achieved a level of significance smaller than the conservative p value of .008 that was set to account for multiple significant tests.

Post hoc (Tukey) tests were used to explore which groups differed on the subscales. On the volition, habituation and communication/interaction subscales, participants with nonpsychotic mental illness were different from both the other groups ($p < .01$), while those with psychoses and organic/cognitive problems were not significantly different from each other. On the process skills subscale, all groups were significantly different from each other ($p < .001$). On the motor skills subscale, clients with organic/cognitive problems were significantly different from the other two groups ($p < .001$), while the psychotic and non psychotic groups were not significantly different from each other. On the environment subscale, the only difference was between clients with nonpsychotic mental illness and those with organic/cognitive mental illness ($p = .004$).

Discussion

Rasch analysis indicated that the items which make up each of the six subscales of the MOHOST worked well together to capture the intended constructs; no items misfit on any of the scales and most *MS* values were near the ideal of 1.0.

Table 3. Person separation statistics on six subscales of the MOHOST

MOHOST subscale	Separation index (G)	Strata H = (4G + 1)/3	Separation reliability
Motivation for occupation	2.24	3.32	.83
Pattern of occupation	2.27	3.36	.84
Communication and interaction skills	2.28	3.37	.84
Process skills	2.82	4.09	.89
Motor skills	2.38	3.51	.85
Environment	2.04	3.05	.81

Table 4. Spearman correlations between MOHOST subscales and HoNOS-PbR items

	Problems with activities of daily living	Problems with activities of daily living	Problems with relationships	Cognitive problems	Physical illness or disability problems	Problems with living conditions
Volition	.23***					
Habituation		.29***				
Communication/ interaction skills			.20***			
Process skills				.45***		
Motor skills					.43***	
Environment						.24***

***$p < .001$. MOHOST = Model of Human Occupation Screening Tool; HoNOS-PbR = National Outcome Scale–Payment by Results.

Table 5. Analysis of variance results for each of the six subscales of the MOHOST among three groups of participants

Subscales	Groups	Mean	*SD*
Motivation for occupation (volition)	Clients with psychosis	2.4	0.68
	Clients with nonpsychotic mental health problems	2.6	0.68
	Clients with organic/cognitive problems	2.3	0.68
Pattern of occupation (habituation)	Clients with psychosis	2.3	0.64
	Clients with nonpsychotic mental health problems	2.5	0.73
	Clients with organic/cognitive problems	2.2	0.64
Communication/interaction skills	Clients with psychosis	2.8	0.73
	Clients with nonpsychotic mental health problems	3.1	0.66
	Clients with organic/cognitive problems	2.9	0.69
Process skills	Clients with psychosis	2.6	0.68
	Clients with nonpsychotic mental health problems	3.0	0.69
	Clients with organic/cognitive problems	2.1	0.72
Motor skills	Clients with psychosis	3.2	0.71
	Clients with nonpsychotic mental health problems	3.2	0.71
	Clients with organic/cognitive problems	2.8	0.77
Environment	Clients with psychosis	2.8	0.71
	Clients with nonpsychotic mental health problems	2.9	0.76
	Clients with organic/cognitive problems	2.7	0.61

MOHOST = Model of Human Occupation Screening Tool.

All subscales were able to distinguish clients into at least three statistically distinct strata with reliability greater than .80. This degree of item separation and reliability is quite acceptable. Greater personal separation and higher reliability might be obtained if each subscale had more items, but the MOHOST was developed through collaboration with practitioners who helped identify the number of items that was sufficient for making clinical judgment while not being too burdensome for everyday practice. These practitioners decided that 24 items constituted a reasonable number of items with which to assess clients given the constraints of time that are inevitable in clinical practice. There is always a tension between creating a

scale that maximizes stability by increasing the number of items and one that is readily used in clinical practice by limiting the number of items. The data from this study suggest that the MOHOST achieves an acceptable level of stability while remaining easy to use in everyday practice.

Overall over 95% of the participants were validly measured if one applies the Rasch definition of validity as establishing unidimensionality of scale items. This was indicated by an average person misfit rate of 4.76%. The range of person misfit rate for the six subscales was between 3.50% and 6.17%. Overall the findings indicate that the participants are validly assessed with the subscales the vast majority of the time.

As expected, moderate correlations were found between the subscales of the MOHOST and items from the HoNOS-PbR that captured related variables. These associations provide evidence of concurrent validity for the subscales based upon correlational findings that demonstrated relationships between the six MOHOST subscales and functional problems identified by the HoNOS-PbR, such as problems with activities of daily living, problems with relationships, cognitive problems, physical illness or disability problems, and problems with living conditions. The ability of the subscales to discriminate between the three subgroups was as expected. Both the psychotic and organic/cognitive groups represent clients with serious mental illness that would be reflected in their volition, habituation, and communication/interaction skills. Thus, it is not surprising that these two groups did not differ from each other but were different from the nonpsychotic group. Moreover, the organic/cognitive group had more severe cognitive impairment that would differentiate them from the psychotic group on the process skills subscale, while the nonpsychotic group would be expected to have better process skills than the psychotic group, as was found. The fact that the organic/cognitive group was differentiated from the other two groups by the motor skills subscale reflects the fact that this group is older and more likely to have motor impairments than the other two groups. Taken as a whole, the findings support the conclusion that the MOHOST subscales are validly capturing the intended constructs. They also indicate that the subscales can effectively differentiate between populations who differ on traits being measured.

Conclusion

This study built upon previous psychometric evidence concerning the MOHOST. It provided evidence from both item response theory and classical test theory approaches. Findings from this study contributed additional evidence that support the conclusion that the MOHOST subscales are reliable and valid. Findings also indicated that the MOHOST is an adequately sensitive measure capable of discriminating between clients.

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